

4.4

1) (a) PRIMARY $x^2 + y^2 = S$ SECONDARY $x + y = 20$ ←
 $(20 - y)^2 + y^2 = S$
 $400 - 40y + y^2 + y^2 = S$
 $400 - 40y + 2y^2 = S$
 $0 = -40 + 4y = S'$
 $\frac{40}{4} = \frac{4y}{4}$
 $10 = y$

FDT

DECR.	INCR
-	+
1	11

10

$10 \in 10$ MW.
 $0 \in 20$ MAX.

(b) $x + \sqrt{y} = S$
 $20 - y + y^{1/2} = S$
 $0 = -1 + \frac{1}{2}y^{-1/2} = S'$
 $1 = \frac{1}{2}y^{-1/2}$
 $1 = \frac{1}{2\sqrt{y}}$
 $2\sqrt{y} = 1$
 $\sqrt{y} = \frac{1}{2}$
 $y = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

$y \neq 0$

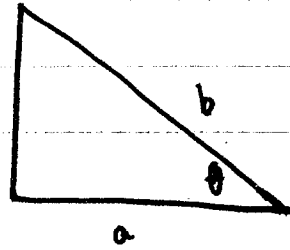
INCR	DECR
+	-
$\frac{1}{16}$	1

$\frac{1}{4}$

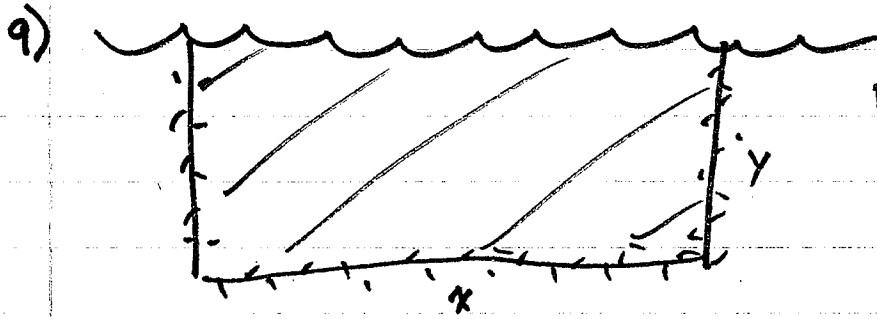
$\frac{1}{4} \in 19\frac{3}{4}$ MAX
 $0 \in 20$ MIN

4.4

15) $A = \frac{1}{2} ab \sin \theta$
 $A' = \frac{1}{2} ab \cos \theta = 0$



INCR	DECR
+	-
$\frac{\pi}{4}$	$\frac{3\pi}{4}$
$\frac{\pi}{2}$	
0	π

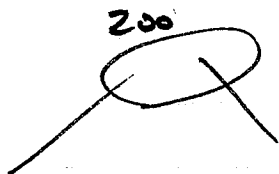


PRIMARY: $A = xy$
 $A = (800 - 2y)y$
 $A = 800y - 2y^2$
 $A' = 800 - 4y = 0$
 $800 = 4y$
 $200 = y$

SECONDARY: $P = x + 2y = 800$
 $x = 800 - 2y$

FDT

INCR	DECR
+	-
100	300



4.4

16)



primary: $SA = \pi r^2 + 2\pi r h$
 $= \pi r^2 + 2\pi r \left(\frac{1000}{\pi r^2} \right)$

$$SA = \pi r^2 + 2000 r^{-1}$$

$$(SA)' = 2\pi r - 2000 r^{-2} = 0 \quad r \neq 0$$

secondary: $V = \pi r^2 h$
 $\frac{1000}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

FD/T	DECR	INCR
	-	+
	1	10
		$\frac{10}{\sqrt[3]{\pi}}$

$$2\pi r = \frac{2000}{r^2}$$

$$2\pi r^3 = 2000$$

$$\pi r^3 = 1000$$

$$r^3 = \frac{1000}{\pi}$$

$$r = \sqrt[3]{\frac{1000}{\pi}}$$

BECAUSE THE FUNCTION CHANGES FROM DECREASING TO INCREASING,
 THERE IS A MINIMUM AT $x = \sqrt[3]{\frac{1000}{\pi}}$.

4.4

1) x - nonnegative number

y - another nonnegative number

$$x + y = 20 \quad \text{secondary}$$

$$(a) \quad S = x^2 + y^2 \quad y = \frac{20-x}{1} \quad \text{primary}$$

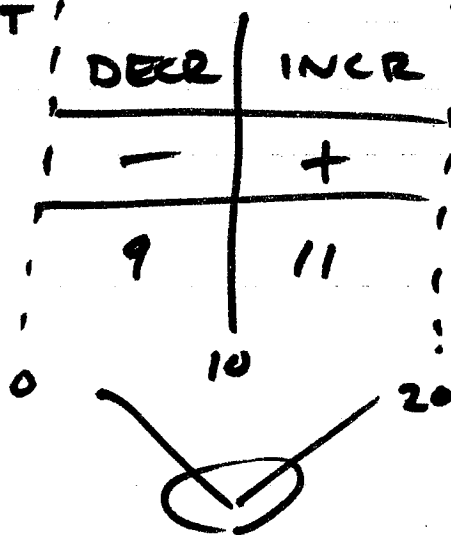
$$S = x^2 + (20-x)^2$$

$$S = x^2 + 400 - 40x + x^2$$

$$S = 400 - 40x + 2x^2$$

$$S' = -40 + 4x = 0$$
$$4x = 40$$
$$x = 10$$

FDT



MIN $x = 10, y = 10$

MAX $0, 20$

#1 4.4

(6) $x + \sqrt{y} = 5$ primary $x + y = 20$ secondary

$$x + y^{1/2} = 5$$

$$x = 20 - y$$

$$20 - y + y^{1/2} = 5$$

g' is undefined at 0

$$-1 + \frac{1}{2}y^{-1/2} = 5' = 0$$

$y \neq 0$

$$\frac{1}{2}y^{-1/2} = 1$$

$$\frac{1}{\sqrt{y}} = 2$$

$$1 = 2\sqrt{y}$$

$$\left(\frac{1}{2}\right)^2 = (\sqrt{y})^2$$

$$\frac{1}{4} = y$$

INCR	DECR
+	-
$\frac{1}{16}$	1
0	20

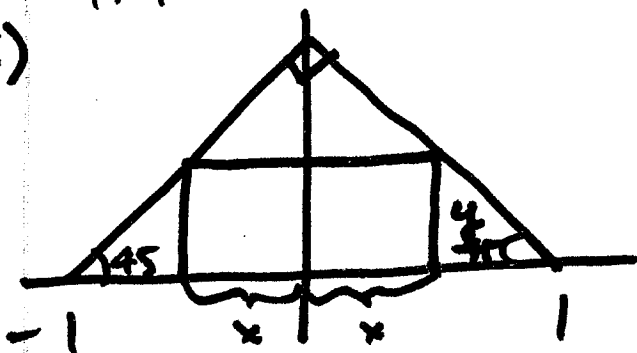
$$-1 + \frac{1}{2} \left(\frac{1}{16}\right)^{-1/2}$$

$$-1 + \frac{1}{2}$$

MAX $\frac{1}{4}, 19\frac{3}{4}$ MIN 0, 20

4.4

5)



(a) $y = 1 - x$ secondary

(b) $A = 2xy$ primary

$A = 2x(1-x)$

$A = 2x - 2x^2$

$A' = 2 - 4x = 0$

$2 = 4x$

$\frac{1}{2} = x$

$\frac{5}{3} \times \frac{14}{3} \times \frac{35}{3}$

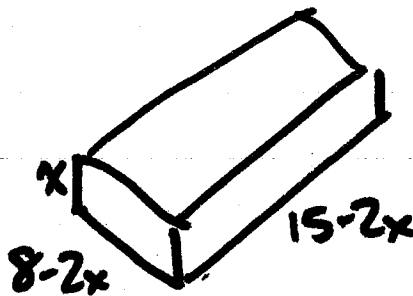
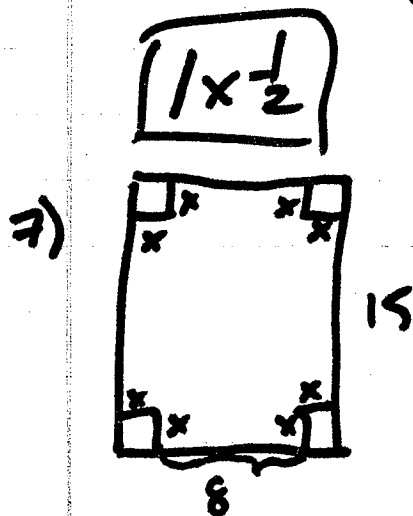
$\frac{5}{3} (8 - 2\frac{5}{3})(15 - 2\frac{5}{3})$

$V = x(8-2x)(15-2x)$

(c) FDT

INCR	DECR
+	-
$\frac{1}{4}$	$\frac{3}{4}$
$\frac{1}{2}$	

$y = 1 - \frac{1}{2} = \frac{1}{2}$



$V = x(120 - 16x - 30x + 4x^2)$

$V = 120x - 46x^2 + 4x^3$

FDT	INCR	DECR	INCR
1	+	-	+
1	1	5	7
0	$\frac{5}{2}$		6

$V' = 120 - 92x + 12x^2 = 0$

$V' = 4(30 - 23x + 3x^2) = 0$

$(5-x)(-3x) = 0$

$(3x-5)(x-6) = 0$

$x = \frac{5}{3} \quad x = 6$

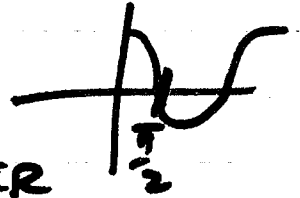
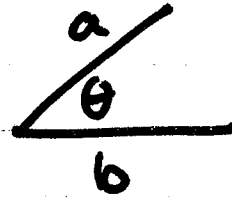
4.4

15) $A = \frac{1}{2} ab \sin \theta$

$$A' = \frac{1}{2} ab \cos \theta = 0$$

$$\cos \theta = 0$$

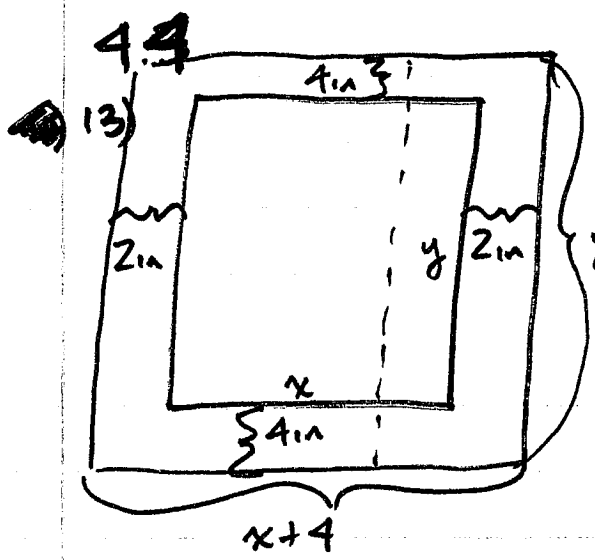
$$\theta = \frac{\pi}{2}$$



FDT INCR DECR

+	-
---	---

~~FI~~



Primary: $A = (x+4)(y+8)$

$A = (50y^{-1} + 4)(y+8)$

$A' = -50y^{-2}(y+8) + (50y^{-1} + 4)$

$-50y^{-2}y - 400y^{-2} + 50y^{-1} + 4$

$-400y^{-2} + 4 = 0$

$400y^{-2} = 4$

$y^{-2} = \frac{1}{100}$

$y^2 = 100$

$y = \pm 10$

$y = 10$

Secondary: $A = xy = 50$

$x = \frac{50}{y} = 50y^{-1}$

EDT

DECR	INCR
-	+
5	11

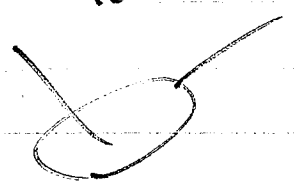
0

10

$-400(5)^{-2} + 4$

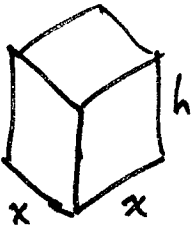
$-400(11)^{-2} + 4$

10" x 5"



4.4

11)



$$V = x^2 h = 500$$

$$h = \frac{500}{x^2} = 500x^{-2}$$

Primary: $SA = 4xh + x^2$

$$4x(500x^{-2}) + x^2$$

$$2000x^{-1} + x^2$$

 $x \neq 0$

$$SA' = -2000x^{-2} + 2x = 0$$

$$2x = \frac{+2000}{x^2}$$

$$x^3 = 1000$$

$$x = 10$$

$$-2000(5)^{-2} + 2(5)$$

$$-2000(12)^{-2} + 2(12)$$

$$\boxed{10 \times 10 \times 5}$$

FDT /

	DECR	INCR
1	-	+
1	5	12



15)